DOCUMENT RESUME

ED 067 296 SE 014 897

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TITLE	Algebra 1p, Mathematics: 5215.11.
INSTITUTION	Dade County Public Schools, Miami, Fla.
PUB DATE	71
NOTE	37p.; An Authorized Course of Instruction for the Quinmester Program
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Algebra; Behavioral Objectives; *Curriculum; Instruction; Mathematics Education; *Objectives; *Secondary School Mathematics; *Teaching Guides; Tests
IDENTIFIERS	*Quinmester Program

ABSTRACT

This is the first of six guidebooks on minimum course content for first-year algebra; it introduces the language of sets, the fundamental operations and properties of the real number system, the use of variables, and the solution of simple linear equations and inequalities. Overall goals for the course are stated; then performance objectives, a unit outline, references to state-adopted texts, and teaching suggestions are concisely given for each topic. A sample pretest and posttest are included along with an annotated list of three references. See SE 014 874 and SE 014 875 for other booklets in the algebra sequence. (DT)

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

QUINMESTER MATHEMATICS

ALGEBRA - 1p

5215.11

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

QUINMESTER MATHEMATICS

COURSE OF STUDY

FOR

ALGEBRA 1p

5215.11

(EXPERIMENTAL)

Written by

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for the

DIVISION OF INSTRUCTION
Dade County Public Schools
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1971-72

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Published by the Dade County School Board

Copies of this publication may be obtained through

Textbook Services
2210 S. W. Third Street
Miami, Florida 33135

PREFACE

The following course of study has been designed to set a minimum standard for student performance after exposure to the material described and to specify sources which can be the basis for the planning of daily activities by the teacher. There has been no attempt to prescribe teaching strategies; those strategies listed are merely suggestions which have proved successful at some time for some class.

The course sequence is suggested as a guide; an individual teacher should feel free to rearrange the sequence whenever other alternatives seem more desirable. Since the course content represents a minimum, a teacher should feel free to add to the content specified.

Any comments and/or suggestions which will help to improve the existing curriculum will be appreciated. Please direct your remarks to the Consultant for Mathematics.

All courses of study have been edited by a subcommittee of the Mathematics Advisory Committee.

CATALOGUE DESCRIPTION

The first of 6 quins which altogether contain all the concepts and skills usually found in first-year algebra. An introduction to the fundamental operations and properties of the real numbers using sets as the basic language. Includes use of variables, solution to simple linear equations and inequalities, and graphing on the real number line.

Designed for the student who has competence in the skills and concepts contained in the 4 quins of Mathematical Structures or 4 quins of Pre-Algebra.

TABLE OF CONTENTS

OVERALL GOALS

The student will...

1. Learn to use set language and set notation.

2. Develop further understanding of the structure of the set of real numbers through the study of its subsets and their properties.

3. Begin to understand the concepts of variable and open sentences.

4. Be able to solve simple linear equations and inequalities using algebraic methods.

5. Develop further skills in computation with rational numbers.

KEY TO REFERENCES

(* State Adopted)

*	D -	Dolciana, Mary; Wooten, William; Beckenbach, Edwin; Jurgensen, Ray; and Donnelly, Alfred. Modern School Mathematics, Algebra 1. New York: Houghton Mifflin, 1967.
	N -	Nichols, Eugene D. Modern Elementary Algebra. New York: Holt, Rinehart, and Winston, 1961.
*	PL -	Payne, Joseph; Zamboni, Floyd; and Lankford, Francis. Algebra One. New York: Harcourt, Brace, Jovanovich, 1969.
*	PA -	Pearson, Helen R. and Allen, Frank B. Modern Algebra: A Logical Approach, Book One. Boston: Ginn and Co., 1964.
	$\boxed{1}$ -	The number in the block preceeding an objective indicates the number of the state assessment standard to which the objective is related.

PERFORMANCE OBJECTIVES

I. Sets

The student will:

1. Write, in roster form, a set which is defined by a rule.

2. Write a rule to designate a set which is defined in roster form.

3. Identify a given set as infinite, finite, or finite and empty.

4. Determine all of the subsets of a set consisting of 3 elements or less.

5. Make a diagram to show one-to-one correspondence between two equivalent sets.

6. Determine whether two given sets are equivalent and equal, equivalent, or non-equivalent.

7. Sketch and label a Venn diagram to illustrate the following:

   $A \cup B$, $A \cap B$, $A \subset B$, $\bar{A}$, $A \cap B = \emptyset$

8. State the relationship, in set notation, that is illustrated by a given Venn diagram.

9. Perform the operations of union, intersection, and complementation on spacified sets.

Course Outline

I. Sets

A. Notation
B. Kinds of Sets

1. Finite
2. Infinite
3. Empty

C. Relations

1. Equal
2. Equivalent
3. Subset
4. Disjoint

D. Operations

1. Union
2. Intersection
3. Complementation

STATE ADOPTED REFERENCES

	D	N	PL	PA
Pages	16-20 22-23	1-4 10-11	1-11	1-5

SUGGESTED STRATEGIES

I. 1. The language of sets should be emphasized in this section; it is easy to dwell much too long on the kinds of sets. A few examples in section I.B should suffice.

2. Under notation, discuss meaning of set, defining a set, naming a set, belonging to a set, and meaning of universal set. As a minimum, the following symbols should be included:

$$\emptyset, \in, \subset, \subseteq, \notin, \{x: \}, \cap, \cup, \ldots$$

Suggested Strategies (Cont'd)

3. To help the student to see the need for the definition of a set, give several non-mathematical examples to show the difference between a collection that is well defined and one that is not well defined. (Payne p. 3)

4. For some reason, students confuse the use of $\in$ and $\subset$; stress that $\in$ is used between an element and a set containing the element, and $\subset$ is used between two sets.

5. The strict use of capital block letters for designating sets, and lower case letters for elements of sets, should help to make the distinction between sets and elements clearer to a student.

6. In developing the concepts of equal and equivalent sets, use one-to-one correspondence in exhibiting two equal sets which are equivalent and also two equivalent sets which are not equal.

7. Use Venn diagrams to illustrate the algebraic definitions of the operations and relations.

8. Students should be made aware of the difference between a relation and an operation; an operation on two sets produces another set, while a relation between two sets is simply a statement about those two sets.

9. The student should realize $\emptyset \neq \{\emptyset\} \neq \{0\} \neq 0$.

10. Following are notes on sets which may be used as a basis for discussion:

    Note that relations do not yield new sets; they simple describe the existing conditions. To get other sets (or subsets), there is a need for operations:

    Definition: BINARY OPERATIONS are those which "work" on two members at a time to produce another member (i.e., on two sets to produce another set).

    Definition: SINGULARY (or UNARY) OPERATIONS are those which "work" on one member at a time to produce another member (i.e., one set to produce another set).

10. (Cont'd)

BINARY OPERATIONS are:

1. INTERSECTION - Given two sets, A and B, we can form from them the set of all elements that are members of both A and B.

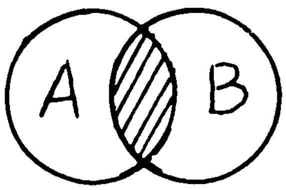
$$A \cap B$$

The operation is called INTERSECTION.

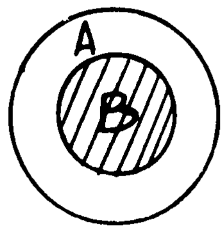
The set is also called the intersection of A and B.

Examples:

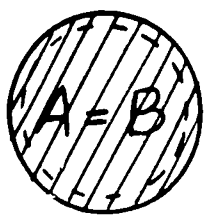
If $A \not\subset B$ and $B \not\subset A$, and $A \cap B \neq \emptyset$, then $A \cap B$ is their common part.



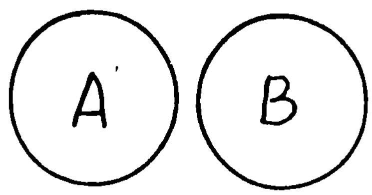
If $B \subset A$, then $A \cap B$ is B.



If $A = B$, then $A \cap B$ is either A or B.



If $A \cap B = \emptyset$ then A and B have no elements in common. A and B are said to be DISJOINT.



2. UNION - Given two sets, A and B, we can form from them the set of all elements that are members of either of A, or of B, or of both.

Suggested Strategies (Cont'd)

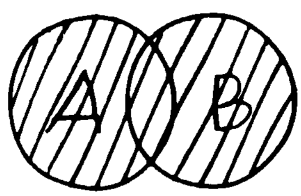
10. (Cont'd)

The operation is called UNION.

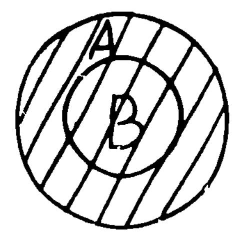
The resulting set is also called the union of A and B.

Examples:

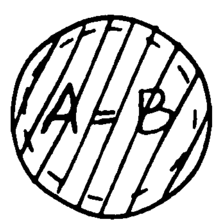
If $A \not\subset B$ and $B \not\subset A$, and $A \cap B \neq \emptyset$, then $A \cup B$ is A and B.



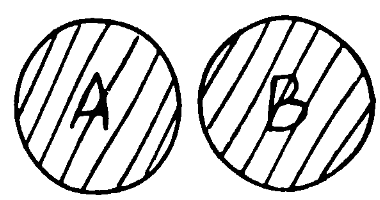
If $B \subset A$, then $A \cup B$ is A.



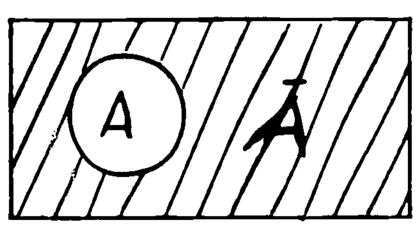
If $A = B$, then $A \cup B$ is either A or B.



If $A \cap B = \emptyset$, then $A \cup B$ is A and B.



The UNARY OPERATION is called COMPLEMENTATION.



The complement of a set A is the set of all elements in the universe which are not members of A.

Suggested Strategies (Cont'd)

10. (Cont'd)

Examples to be used to reinforce understanding of notation:

Suppose our universe is all automobiles. Suppose A is the set of all 1971 models, and B is the set of all Fords, and C is the set of all compact cars.

1. **Describe in words the sets of cars represented by the following:**

a. $A \cap B$	f. $\overline{A \cap B}$
b. $A \cup B$	g. $\bar{A} \cup \bar{B}$
c. $\bar{A}$	h. $\overline{A \cup B}$
d. $\bar{A} \cap B$	i. $\bar{A} \cap \bar{B}$
e. $A \cap \bar{B}$	j. $(\bar{A} \cap B) \cup (A \cap \bar{B})$

2. **Translate each of the following into verbal statements. Determine whether the statement is true or false.**

a. $B \cap A \neq \emptyset$	d. $A \cap B = \emptyset$
b. $B \subset A$	e. $(A \cap B) \subset C$
c. $\bar{A} \cap B = \emptyset$	f. $\overline{A \cap B} \neq \emptyset$

3. **Into which of the 3 classes $A \cap B$, $A \cup B$, $\bar{A} \cap \bar{B}$, do the following cars fall?**

a. 1971 Chevrolets	c. 1964 Fords
b. 1971 Fords	d. 1968 Plymouths

ANSWER KEY

1. a. 1971 Fords
   b. All Fords and all 1971 cars
   c. All cars except 1971 cars
   d. All Fords except 1971 models

Suggested Strategies (Cont'd)

10. (Cont'd)

1. Answer Key (Cont'd)

e. All 1971's except Fords
f. All cars except 1971 Fords
g. All cars except 1971 Fords
(Note: f and g are equivalent)
h. All cars not 1971 models and not Fords
i. All cars except 1971's and Fords
(Note: h and i are equivalent)
j. All Fords except 1971 Fords and all 1971's which are not Fords

2. a. There are 1971 models of Fords (T)
b. All Fords are 1971 models (F)
c. All Fords are 1971 models (F)
(Note: b and c are equivalent)
d. There are no 1971 Fords (F)
e. All 1971 Fords are compacts (F)
f. There are some models other than 1971 Fords (T)

3. a. $A \cup B$ c. $A \cup B$

b. $A \cap B$ d. $\bar{A} \cap \bar{B}$

PERFORMANCE OBJECTIVES

II. Real Numbers

The student will:

[2] 1. Graph, on a number line, the elements of a set of rational numbers.

2. Write a comparison statement between any two rational numbers.

[4] 3. Compute the sum, difference, product, and quotient of any pair of rational numbers.

4. Find the terminating or repeating decimal equivalent to a given rational number.

5. Apply the definition of irrational numbers (any number that is non-repeating and non-terminating when written in its decimal form) in identifying irrational numbers.

6. Classify elements of a given set of real numbers as natural, whole, integral, rational, or irrational.

7. State, in set notation, the relation that exists between two subsets of the real numbers.

Course Outline

II. Real Numbers

A. Use of number line
B. Recognition of subsets

1. Naturals
2. Wholes
3. Integers
4. Rationals

a. Repeating decimals
b. Terminating decimals
c. Quotient of two integers

5. Irrationals (as non-repeating, non-terminating decimals.)
6. Arithmetic of rational numbers

STATE ADOPTED REFERENCES

	D	N	PL	PA
Pages	1-8	55-78	30 52-56	2-47

SUGGESTED STRATEGIES

II. 1. Use the language of sets consistently in developing the ideas of this section. For example, the student will be asked to:

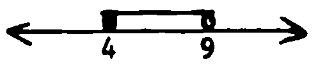
(a) Exhibit the set A on a number line if...

$$A = \{ x: \ x \in \{\text{Naturals}\} \ \text{and} \ x \leq 5 \}$$

(b) Write the algebraic description of B and C in set notation if B and C are the sets pictured.

B

C



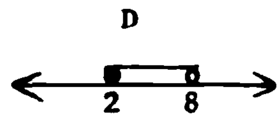
2. Describe whole numbers as "non-negative integers."

3. The fact that the set of rational numbers includes negative fractions (proper and improper) as well as integers is often overlooked by the student; include many of these in the discussion of subsets of rationals.

4. To aid the student in visualizing the real numbers included in a set pictured on a number line, use an example such as:

Suggested Strategies (Cont'd)

4. (Cont'd)

Given: 

$$C = \left\{ \sqrt{2},\ \frac{4}{3},\ \frac{11}{2},\ \sqrt{16},\ 5.7,\ 7.9,\ 8,\ 8.4 \right\}$$

Which elements of C are in D?

5. The following anecdote has been of help to some in remembering the sign laws for multiplication.

   a. When a good man comes to town, that's good! (+)
   b. When a bad man comes to town, that's bad! (-)
   c. When a good man leaves town, that's bad! (-)
   d. When a bad man leaves town, that's good! (+)

	+ coming in town	- going out of town
good man +	a +	c -
bad man -	b -	d +

6. Short drill each day from flash cards will facilitate the development of skills in the arithmetic of signed numbers.

7. The arithmetic of signed numbers provides a good opportunity to review the arithmetic of fractions and decimals; students usually need a great deal of practice to gain skill sufficient for future work.

8. Stress the one-to-one correspondence between the set of real numbers and the set of points on a line.

PERFORMANCE OBJECTIVES

III. Use of Variables

The student will:

$\boxed{7}$ 1. Evaluate an algebraic expression, for a given replacement set, with and without functional notation.

2. Simplify an algebraic expression by:

   a. using the order of operations
   b. combining similar terms
   c. applying the distributive property

3. Demonstrate his understanding of algebraic notation by:

   a. Translating a verbal statement into an equivalent statement using variables and other mathematical symbols.
   b. writing a verbal statement equivalent to a given algebraic sentence.

Course Outline

III. Use of Variables

A. Simplifying expressions

   1. Combining similar terms
   2. Order of operations
   3. Distributive property

B. Evaluating expressions

   1. Substitution
   2. Functional notation

C. Translating statements

   1. Verbal to mathematical
   2. Mathematical to verbal

STATE ADOPTED REFERENCES

	D	N	PL	PA
Pages	10-16 26-29 52-59 120-123	32-33 133-135	16-19 86-92 128-132	18 53-54 219 237 241

SUGGESTED STRATEGIES

III. 1. In evaluating expressions, the symbol f(x) can be introduced as a second and shorter way of denoting an expression such as $x^3 - 2x + 7$. By asking for the value of the expression for a given number, n, indicated by f(n), the student will be using functional notation and also practicing evaluating the expression.

2. The use of evaluating expressions as a device to review operations with fractions and decimals cannot be overly emphasized.

3. The use of the distributive property in simplifying expressions (such as $8x + 3y + 2x = 10x + 3y$) is often not apparent to the beginning student.

4. The frequent use of short quizzes (5 or 10 minutes) has a three-fold purpose: to reinforce student's understanding, increase his skill, and keep the teacher informed on his progress.

* 5. Translation is perhaps the most difficult concept in this course; ideas should be developed regularly throughout the year.

PERFORMANCE OBJECTIVES

IV. First Degree Open Sentences

1 The student will:

$\boxed{2}$ 1. Solve equations of the form $ax + b = c$ (where a, b, and c are integers and x is real) by applying the properties of equality.

$\boxed{2}$ 2. Find the algebraic solution of an inequality of the form $ax + b \leq c$ (where a, b, and c are integers and x is real) by applying the properties of inequality.

$\boxed{2}$ 3. Graph, on a number line, the solution set of any inequality of the form $ax + b \leq c$ (where a, b, and c are integers and x is real).

Course Outline

IV. First Degree Open Sentences

A. Equations
B. Inequalities in one variable

1. Algebraic solution
2. Graphic solutions

STATE ADOPTED REFERENCES

	D	N	PL	PA
Pages	145-146 157-168	182-185	112-121 141-148	62-66

SUGGESTED STRATEGIES

IV. 1. Using only $<$ (rather than both $>$ and $<$) will simplify discussions; students will find the work easier if they always read from left to right. Numbers then always appear in increasing order and the order of the algebraic statement is the same as the order on the number line.

2. In solving inequalities of the form $-ax + b \leq c$, $a \in N$, use the additive property of inequalities to transform the sentence into an equivalent inequality with a positive coefficient of x, i.e., $b \leq c + ax$. This avoids the problem of having to reverse the inequality when multiplying by a negative number.

3. Simple equations can be solved by the "cover up" method given in Nichol's Modern Elementary Algebra, on page 178.

4. The uses of properties of equality (inequality) should be discussed in conjunction with solutions of equations (inequations).

5. Compare properties of equality to those of inequality.

6. Formal use of properties should not be duscussed at this stage; there will be further development in quins which follow.

SAMPLE PRETEST

I. 1. Write each of the following sets in roster form.

a. the set of whole number multiples of 3
b. the set of natural numbers greater than 5 but less than 10

2. Write a rule to describe each of the following sets.

a. $\{1, 2, 3, 4, 5\}$
b. $\{1, 3, 5, 7 \ldots\}$

3. Given the following sets, identify the finite sets (F), the infinite sets (I), and the empty sets (E). A set may have more than one letter attached to it.

a. the set of natural numbers
b. $\{0\}$
c. the set of whole numbers less than zero.

4. List all the subsets of A if $A = \{a, b, c\}$.

5. Show that there is a one-to-one correspondence between sets E and O if E = {positive even whole numbers} and O = {positive odd whole numbers}.

6. Classify each of the following pairs of sets as equal, equivalent, both equal and equivalent, or neither equal nor equivalent.

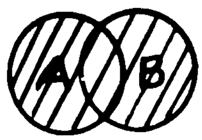
a. $\{1, 3, 7\}$, $\{3, 1, 7\}$
b. $\{6, 5, 7\}$, $\{6, 5, 8\}$
c. $\{3, 9\}$, $\{9, 3, 1\}$

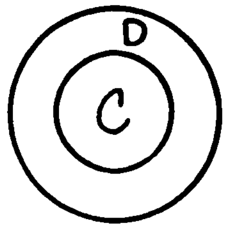
7. Draw and label a Venn diagram to illustrate each of the following.

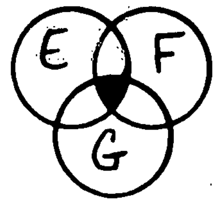
a. $\{1, 6, 5\} \cap \{3, 6, 9, 7\}$
b. $C \cap N$ if $C \subset N$
c. $\{6, 8\} \cup \{1, 4, 5\}$

d. $\bar{A}$

8. Use set notation to state the relationship shown by each of the Venn diagrams.

a. 

b. 

c. 

9. If $U = \{1, 2, 3, 4, 5\}$, $A = \{1, 3, 5\}$, $B = \{3, 5\}$, and $C = \{4\}$, find the set represented by each of the following.

a. $A \cup B$

b. $A \cap B$

c. $\overline{C}$

d. $\overline{B}$

e. $A \cap C$

II. 1. Graph the following real numbers on a number line and label each point.

a. $-\frac{1}{2}$

b. $\sqrt{5}$

c. $\frac{8}{3}$

d. -1.75

2. Write the symbol $<$ or $>$ that should be inserted between each pair of numbers to make a true statement.

a. -4, 3
b. -5, -2
c. -1.5, -1.7

Sample Pretest (Cont'd)

3. Label each of the following as a natural, whole, integral, rational, or irrational number. (It is possible that one number may be labeled by more than one of these adjectives.)

a. $2\frac{1}{2}$

b. $-\frac{4}{5}$

c. 3

d. -2

e. 3.1416

f. $\sqrt{4}$

g. π

4. Label each of the following statements as true or false.

a. rationals $\subset$ reals
b. integers $\cap$ rationals = $\emptyset$
c. integers $\subset$ wholes
d. rationals $\cup$ irrationals = reals

5. Change each of the following to decimal form and identify as terminating or repeating decimals.

a. $\frac{2}{3}$ b. $\frac{1}{5}$ c. $\frac{2}{11}$

6. Perform the indicated operations.

a. $-12 + (-5)$

b. $-4(-\frac{3}{8})$

c. $14 \div (-\frac{2}{3})$

d. $-3\frac{2}{3} - 1\frac{1}{6}$

e. $4 + (-13)$

f. $1.3 - (-.78)$

g. $-9 - (-3)$

h. $-9 \div (-1.5)$

i. $1.6(-3.2)$

7. Identify each of the following numbers that is irrational.

a. 1.2161661666...
b. 5.462
c. $.492\overline{92}$

III. 1. a. Evaluate $\frac{a^2 - 4}{n}$ when $a = -1$

b. Evaluate $\frac{n}{n + 2}$ when $n = \frac{1}{2}$

c. Find $f(4)$ if $f(x) = x^2 - 2x$

d. Find $f(-2)$ if $f(x) = \frac{1}{4}x - 2x^2 + 3$

2. Simplify each of the following expressions.

a. $3 \times 4 - 6 \div 2$
b. $4 + 8 \div 2 - 1 \times 4$
c. $2x - 3y + 7x - 4y$
d. $3ab - 7ab + 9$
e. $3(x - 4) + 6(3x + 5)$
f. $xy - 2x(y - 4) + 7x$

3. Translate each of the following phrases into a mathematical expression.

a. Five more than half of a certain number
b. One half of the sum of 5 and a certain number

Translate each of the following mathematical sentences into a verbal statement.

c. $5x > 7$
d. $6a - 3 = 9$

IV. 1. Solve

a. $5x = 8$
b. $5 - y = 19$
c. $3 - 2x = 12$

2. Solve

a. $x - 3 < 5$
b. $4x + 2 > 7$
c. $9 - 3x \geq 6$

3. Graph each of the following sets of real numbers on a number line.

a. $\{x: x < 3\}$ b. $\{y: y \geq -\frac{2}{3}\}$

SAMPLE PRETEST
ANSWER KEY

I. 1. a. $\{0, 3, 6, 9\ldots\}$
b. $\{6, 7, 8, 9\}$

2. Answers may vary:

a. the set of whole numbers between zero and six
b. the set of odd whole numbers

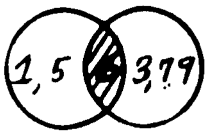
3. a. I
b. F
c. F, E

4. $\emptyset, \{a\}, \{b\}, \{c\}, \{a,b\}, \{a,c\}, \{b,c\}, \{a,b,c\}$

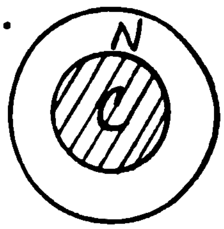
5.
$$\begin{array}{ccccccc} 2 & 4 & 6 & 8 & \ldots & n & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 1 & 3 & 5 & 7 & \ldots & n-1 & \ldots \end{array}$$

6. a. equal and equivalent
b. equivalent
c. neither

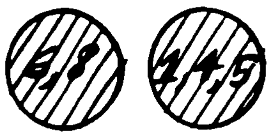
7. a.



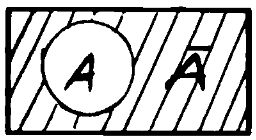
b.



c.



d.

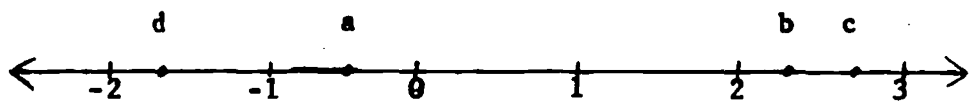


8. a. $A \cup B$
b. $C \subset D$
c. $E \cap F \cap G$

Sample Pretest Answer Key (Cont'd)

9. a. $\{1, 3, 5\}$
   b. $\{3, 5\}$
   c. $\{1, 2, 3, 5\}$
   d. $\{1, 2, 4\}$
   e. $\emptyset$

II. 1.



2. a. $<$
   b. $<$
   c. $>$

3. a. rational
   b. rational
   c. natural, whole, integral, rational
   d. integral, rational
   e. rational
   f. natural, whole, integral, rational
   g. irrational

4. a. T
   b. F
   c. F
   d. T

5. a. $.\overline{6}$ repeating
   b. .2 terminating
   c. $.\overline{18}$ repeating

6. a. -17
   b. $\frac{3}{2}$
   c. -21
   d. $-4\frac{5}{6}$
   e. -9
   f. 2.08
   g. -6
   h. 6
   i. -5.12

7. a. Ir.
   b. No.
   c. No.

Sample Pretest Answer Key (Cont'd)

III. 1. a. 3   c. 8

b. $\frac{1}{5}$ d. -7

2. a. 9   d. $-4ab + 9$

b. 4   e. $21x + 18$

c. $9x - 7y$ f. $-xy + 15x$

3. a. $\frac{x}{3} + 5$

b. $\frac{1}{2}(5 + x)$

Answers may vary:

c. Five times a certain number is more than 7

d. Six times a certain number is diminished by three and the result is nine

IV. 1. a. $\frac{8}{5}$

b. -14

c. $-\frac{9}{2}$

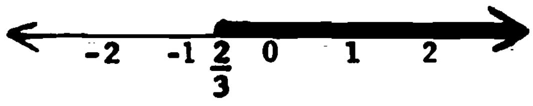
2. a. $x < 8$

b. $x > \frac{5}{4}$

c. $x \leq 1$

3. a.

b.



SAMPLE POSTTEST

I. 1. Write each of the following sets in roster form.

a. the set of natural numbers between 6 and 11
b. the set of whole number multiples of 7
c. the set of natural numbers that are factors of 12

2. Write a rule to describe each of the following sets.

a. $\{0, 5, 10, 15... \}$
b. $\{2, 4, 6\}$
c. $\{1, 2, 3, 4\}$

3. Classify each of the following sets as infinite (I), finite (F), finite and empty (F,E).

a. even whole numbers between 6 and 8
b. $\{1, 3\}$
c. the set of natural number multiples of 6

4. List all the subsets of $\{1, 3, 5\}$.

5. Show a one-to-one correspondence between sets A and D if a = {natural numbers} and D = {perfect squares}.

6. Classify each of the following pairs of sets as equal or not equal.

a. $\{1, 2\}$; $\{3, 4\}$
b. $\{0, 1\}$; $\{1, 0\}$
c. $\{3, 4\}$; $\{4, 5, 6\}$

Classify each of the following pairs of sets as equivalent or not equivalent.

d. $\{0, 2\}$; $\{4, 5\}$
e. $\{9, 7\}$; $\{7, 9\}$
f. $\{3, 7\}$; $\{3, 5, 7\}$

7. Let $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 2, 3\}$, $B = \{3, 2, 5\}$, and $C = \{1, 2\}$.

Sample Posttest (Cont'd)

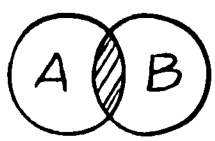
7. (Cont'd)

a. Make a Venn diagram relating A, B, and U
b. Make a Venn diagram relating A, C, and U
c. Make a Venn diagram illustrating $B \cup C$

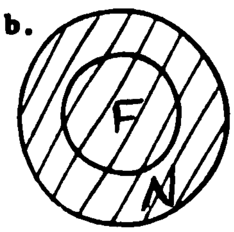
d. Make A Venn diagram illustrating $\overline{C}$
(Label each diagram)

8. Use set notation to state the relationship shown by the shaded region in each of the Venn diagrams.

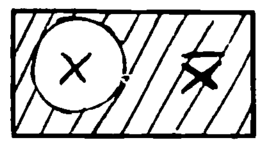
a.



b.



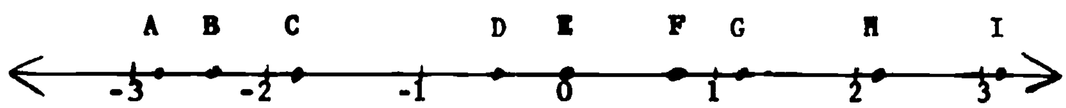
c.



9. If $U = \{0, 2, 4, 6, 8\}$, $A = \{0, 2, 8\}$, $B = \{0, 6\}$, and $C = \{4, 6, 8\}$, find the set represented by each of the following.

a. $A \cup B$
b. $A \cap C$
c. $\overline{A \cup C}$
d. $\overline{B}$

II. 1. Give the letter name of each point whose coordinate is listed below.



a. $-\frac{1}{2}$ 1

b. 1.2

c. $\sqrt{10}$

d. $-\frac{12}{7}$

2. Determine which number, in each of the following pairs, is the larger number.

   a. -5, 3
   b. -4, -2
   c. 6, -1
   d. -1.4, -1.6

3. List all of the numbers of the set $\{7, -\frac{3}{2}, \sqrt{3}, 0, -1.6, 1.414\}$ that are members of each of the sets given below.

   a. {whole numbers}
   b. {irrational numbers}
   c. {natural numbers}
   d. {rational numbers}

4. Label each of the following statements as true or false.

   a. integers $\cap$ rationals = integers
   b. rationals $\cap$ irrationals = $\emptyset$
   c. reals $\subset$ irrationals
   d. wholes $\subset$ integers

5. Change each of the following fractions to decimal form and identify as terminating or repeating decimals.

   a. $\frac{3}{8}$ b. $\frac{5}{12}$ c. $\frac{2}{9}$

6. Perform the indicated operations.

   a. $-7 - (-4)$
   b. $-3(-1.4)$
   c. $-2\frac{1}{2} - 1\frac{1}{4}$
   d. $-16 \div \frac{2}{3}$
   e. $-12 + (-9)$
   f. $\frac{4}{5}(-\frac{3}{8})$
   g. $-6.4 \div (-.08)$
   h. $7 + (-15)$
   i. $2 - (-1.6)$

Sample Posttest (Cont'd)

7. Identify each of the following numbers that is irrational.

a. 3.61626364...

b. $.491\overline{36}$

c. .101101110

III. 1. a. Evaluate $\frac{x}{2 - x}$ when $x = -\frac{2}{3}$

b. Evaluate $\frac{y^2 - 6}{2y}$ when $y = 2$

c. Find $f(-3)$ if $f(x) = 2x^3 - 3x$

d. Find $f(1)$ if $f(n) = 5n^3 - \frac{2}{3}n + 7$

2. Simplify the given expressions.

a. $6 \div 3 \cdot 2 - 4 \cdot 3 + 2$
b. $9 + 3 \div 1 + 3$
c. $a + 5m + 2a - 4m$
d. $6ab - 5ac + 3ac$
e. $4(y - 7) - 3(y + 2)$
f. $5x^2 - 3x(x + 4) = 3x$

3. Write the following in algebraic symbols.

a. x diminished by y
b. the product of twice a number and twelve
c. half the sum of six and three times a number

Write the following as verbal statements.

d. $x + 2 = 4$
e. $6 - 2y > 9$

f. $\frac{1}{2}(x - 3) \leq 2$

Sample Posttest (Cont'd)

IV. 1. Solve.

a. $y - 7 = 15$
b. $5x + 12$
c. $4 - 2n = 8$
d. $5d - 1 = 0$

2. Solve.

a. $n + 4 < 3$
b. $6x \geq 9$
c. $5y - 3 > 4$
d. $7 - 3m \leq 1$

3. Graph each of the following sets of real numbers on a number line.

a. $\{y: \ y > \frac{1}{2}\}$

b. $\{x: \ x \leq -2\}$

SAMPLE POSTTEST
ANSWER KEY

I. 1. a. {7, 8, 9, 10}
b. {0, 7, 14, 21...}
c. {1, 2, 3, 4, 6, 12}

2. Answers may vary:

a. the set of whole number multiples of five
b. the first three even natural numbers
c. the first four natural numbers

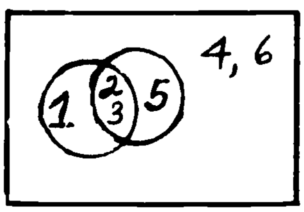
3. a. F, E
b. F
c. I

4. $\emptyset$, {1}, {3}, {5}, {1,3}, {1,5}, {3,5}, {1,3,5}

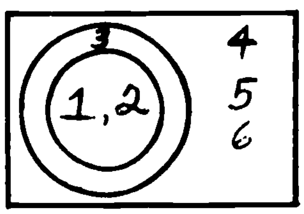
5.
$$\begin{array}{ccccccc} 1 & 2 & 3 & 4 & \dots & n & \dots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 1 & 4 & 9 & 16 & \dots & n^2 & \dots \end{array}$$

6. a. not equal
b. equal
c. not equal
d. equivalent
e. equivalent
f. not equivalent

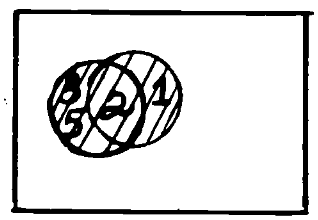
7. a.



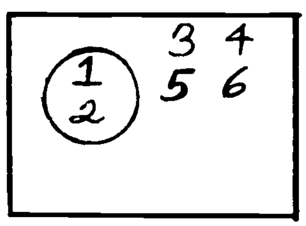
b.



c.



d.



Sample Posttest Answer Key (Cont'd)

8. a. $A \cap B$
   b. $F \cup N$
   c. $\bar{X}$

9. a. $\{0, 2, 6, 8\}$
   b. $\{8\}$
   c. $\emptyset$
   d. $\{2, 4, 8\}$

II. 1. a. D
   b. G
   c. I
   d. C

2. a. 3
   b. -2
   c. 6
   d. -1.4

3. a. 0, 7
   b. 3
   c. 7
   d. $7, -\frac{3}{2}, \sqrt{3}, 0, -1.\overline{6}, 1.414$

4. a. T
   b. T
   c. F
   d. T

5. a. .375 terminating
   b. $.41\overline{6}$ repeating
   c. $.2\overline{2}$ repeating

Sample Posttest Answer Key (Cont'd)

6. a. -3
   b. 4.2
   c. $-3\frac{3}{4}$
   d. -24
   e. -21
   f. $\frac{3}{10}$
   g. 80
   h. -8
   i. 3.6

7. a. irrational
   b. no
   c. no

III. 1. a. $-\frac{1}{4}$

   b. $-\frac{1}{2}$

   c. -45

   d. $11\frac{1}{3}$

2. a. -6
   b. 15
   c. $3a + m$
   d. $6ab - 2ac$
   e. $y - 34$
   f. $2x^2 \cdot 15x$

3. a. $x - y$
   b. $2x \cdot 12$
   c. $\frac{1}{2}(6 + 3x)$
   d. A number increased by two is equal to four
   e. Six decreased by twice a number is more than nine
   f. Half the difference of a number and three is less than or equal to two

Sample Posttest Answer Key (Cont'd)

IV. 1. a. $y = 22$

b. $x = \frac{12}{5}$

c. $n = -2$

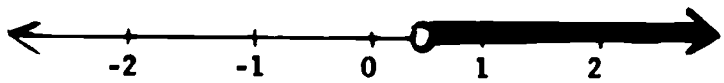
d. $d = \frac{1}{5}$

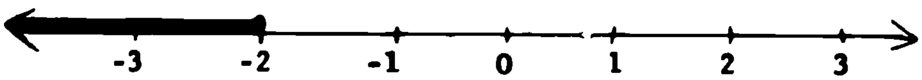
2. a. $n < 1$

b. $x \geq \frac{3}{2}$

c. $y > \frac{7}{5}$

d. $m \geq 2$

3. a. 

b. 

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